AGRICULTURAL Research

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PALLET BOXES

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A Trend

There's been only one interruption since 1957 in the downward trend of annual losses caused by European corn borers.

Loss in 1961, the lowest in 9 years, was less than half what it was in 1954 and 1955. It was still substantial enough, however, for corn borers to remain near the top of any listing of insects destructive to agriculture.

Scientists say it is hard to credit this trend to any one thing. Weather conditions are one of the dominant influences controlling borer population, but it is unlikely that weather alone would consistently push borer population lower and lower.

Research, and its use by corn farmers, must be a major factor. Research provided recommended cultural practices, including methods for disposal of stalk residue, as a start toward logical and effective borer control.

Insecticides are effective in protecting corn. New and highly effective insecticides that are efficient and economical are being produced and tested. Research continues toward design of equipment to permit easier, more accurate application.

The use of resistant varieties, developed through Federal-State research, is increasing each year. Such research has been underway for many years. Lines having considerable resistance or tolerance to borers are released to breeders who blend these qualities into agronomically desirable hybrids.

Research in biological control has resulted in the introduction of 24 species of parasites of corn borers. Six species are established and, of these, five are abundant enough in one or more areas to be of aid in control. In Kansas in 1961, 13 percent of the borers were infected with tachina fly, one of the parasites; only 4 percent were infected with this fly in 1960.

Accurate evaluation of economic benefits from parasites is difficult. Parasitization of more than 50 percent of the borers has been observed in some sections. This is high enough to indicate that many borers are killed by parasites.

Research on control methods continues. It is generally agreed that no one method gives all the control needed. Emphasis continues on the control methods which can be used with little additional cost to farmers.

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Growth Through Agricultural Progress

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Air Sacs in Poultry

Before respiratory ailments of poultry became so bothersome (due to the rapid increase of intensive poultry raising) nobody could assess the practical value of basic USDA studies of poultry respiration.

Then the incidence of respiratory diseases began increasing, with a corresponding increase in poultry condemnations by poultry inspectors. As a result, many scientists began studying the diseases. However, they first needed to know the location, structure, and function of the bird's lungs and air sacs.

Scientific literature didn't contain the needed information. But ARS anatomists had such knowledge. They had been studying poultry anatomy at USDA's Regional Poultry Research Laboratory, East Lansing, Mich., since 1940.

The findings, some of which are shown here, are valuable to scientists in disease research and poultry inspection. But the findings should be more valuable in the future—supplying fundamental information to students.

■ Small wonder that respiratory ailments cause more than half of all poultry condemnations. The bird's breathing system extends, literally, from head to tail.

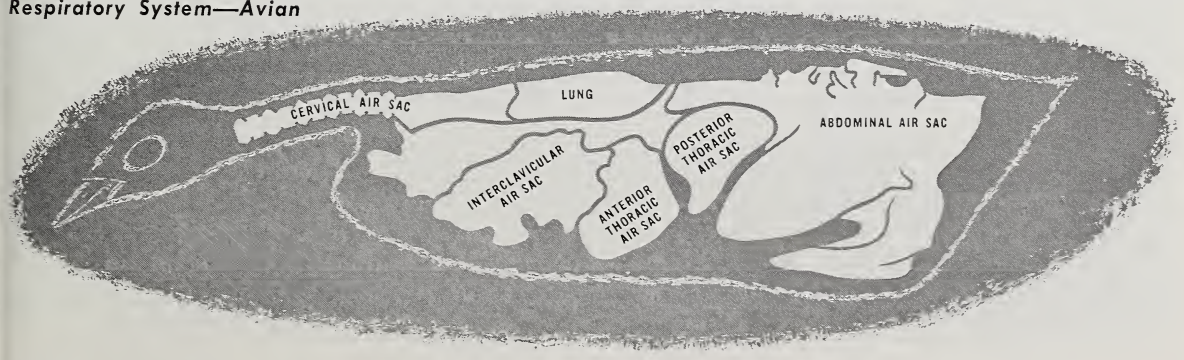
Not that its lungs are oversized. They are smaller, relatively, than a mammal's. The bird's air sacs—which mammals don't have—made its respiratory system so extensive, says ARS research zoologist A. M. Lucas, who has extensively studied the anatomy of avian respiration.

He says air sacs perform several functions. Air sacs, especially those within the bones, make the bird relatively lighter than the mammal, possibly enabling flight. Other functions that air sacs are believed to perform include storing air for use during flight, helping control body temperature, and, to a small extent, helping evaporate water within the body.

Air sacs aren't all balloonlike structures. Some extend into many of the bones. Others encircle organs.

The two abdominal air sacs are largest. They interfold around all the abdominal organs except the liver. These air sacs have canallike extensions (diverticula) arising from their dorsal margins. These diverticula encircle the kidneys, penetrate pelvic vertebrae, cushion the hip joint, and, in some wild birds, penetrate into thigh bones.

Respiratory System—Avian



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Air Sacs in Poultry

(*Continued*)

The cervical air sacs (two in the turkey, one in the chicken) lie mostly above the windpipe and the esophagus. Some of the diverticula form channels that run the length of the neck. Cross connections between channels penetrate the neck bones and form cushions between vertebrae. Other diverticula go through thoracic vertebrae and enter some of the ribs.

Most of the interclavicular air sac is behind and below the windpipe. But its diverticula extend below the heart and enter into the breast, wing, and shoulder bones, and into areas between muscle layers of the breast.

The anterior and posterior thoracic air sacs have no diverticula. The anterior pair is large in chickens and small in ducks. The posterior pair is small in chickens, large in ducks, and absent in turkeys. These air sacs lie between the interclavicular and abdominal air sacs.

Little or no oxygen or carbon dioxide exchange occurs in the air sacs, which contain few blood vessels and have comparatively small surface areas. Instead, most inhaled air goes from the windpipe, through the main bronchial tubes of the lungs, and into abdominal air sacs. Other air sacs don't receive much inhaled air.

The bird exhales by compressing its inflated air sacs and its body wall and lung muscles. The air is pushed back into the main bronchi, then through secondary bronchi and small parabronchi—the respiratory units where the oxygen-carbon dioxide exchange takes place. The air then travels through other secondary bronchi, through the main bronchial tubes of the lungs, and out the windpipe.☆

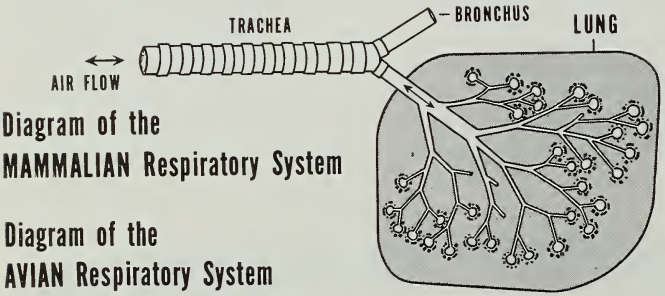


Diagram of the MAMMALIAN Respiratory System

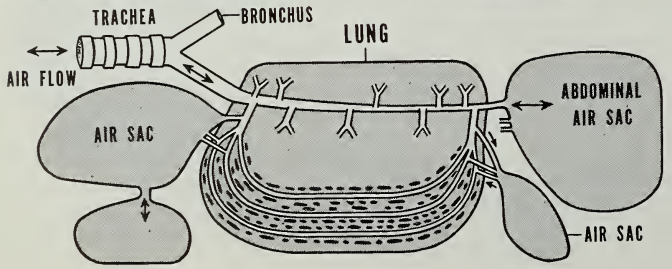


Diagram of the AVIAN Respiratory System

Seventh in a Centennial Series

■ How is sediment transported in streams? What conditions facilitate soil blowing and washing? How does water move through soil? What chemical processes make mineral nutrients in soil available to plants?

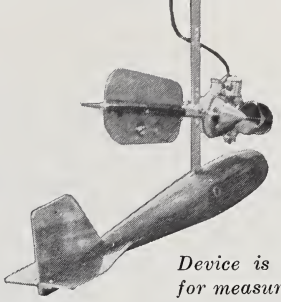
ARS scientists are answering basic questions such as these as they develop methods for preserving our two most valuable resources—soil and water. The welfare and happiness of every citizen requires answers to these questions. And the conservation practices devised, once basic knowledge is gained, must be practical as well as effective.

Until about 50 years ago, the United States was so abundantly endowed with soil and water resources that few people were concerned about preserving them. Some studies began shortly after the Civil War, though there was little popular demand for research. These studies were based mainly on trial and error methods rather than on basic scientific principles.

Realization that soils are individualistic and changing—not "storage bins" of fine rock material—led to the nationwide system of soil surveys and classification. Classification made possible orderly research planning and interpreting of results.

By the 1920's and 1930's, public concern over soil erosion and declining fertility was so great that teams of scientists were assigned to develop principles and techniques for solving soil and water conservation problems. These teams studied the erosive power of the raindrop, ground covers and mulches for controlling erosion, the

SOIL AND WATER



Device is lowered into streams for measuring rate of waterflow.

influence of degree and length of slope on soil and water losses, and watershed treatments to restrict downstream flooding.

Current research is aimed at preventing predictable shortages of soil and water resources. And it is helping to solve pressing current conservation problems—particularly those encountered by USDA's Soil Conservation Service.

Much water is lost through plants

Since 70 percent of the total U.S. water supply is lost through evaporation and transpiration by plants, soil scientists are seeking ways to restrict these losses. First, the researchers must better understand basic principles. Included are complex interrelations of precipitation, radiant energy from the sun, wind velocity and turbulence, and water movement through soil and plants. From these studies may come procedures that reduce water losses from growing crops and farmland.

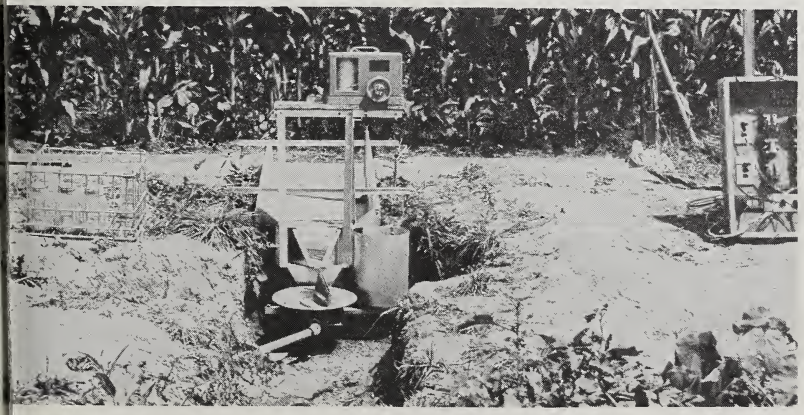
Scientists are testing low-cost materials that will save water by restricting seepage from irrigation canals and reservoirs. Researchers also are studying means of recharging underground aquifers (water-bearing formations), using saline irrigation water, and reusing waste water.

ARS engineers are developing more refined methods of predicting floodflows and water yields from upstream watersheds, defining sedimentation processes, devising criteria for stream channel stabilization, and developing new knowledge for design of water-control structures. Need for this information has been intensified by growth of population and industry. This growth has been attended by increased demand for water and more intensive use of river valleys.

And engineers are developing equipment to replace hand labor in irrigation—one of the few remaining hand labor tasks in agriculture. The equipment automatically starts and stops irrigation pumps and regulates operation of dams and border outlets in ditches.

USDA research such as this during the past years has developed scientifically sound soil and water management practices. And farmers are applying these practices to conserve basic natural resources for the benefit of the entire United States.☆

Runoff and soil-loss plots are used in developing practices for controlling water erosion. Water and sediment are collected after simulated rainstorms to evaluate land treatments. Sediment also is sampled in streams.



Gaging stations measure runoff from research watersheds as scientists test runoff-restricting measures.

Scientist recognizes two soil zones in corn fields as basis for

NEW APPROACH TO CORN TILLAGE

■ Tillage requirements of soil in corn rows and between the rows are different; therefore, the two soil areas should be managed differently.

This principle is the basis for a new method being developed in USDA research to evaluate tillage systems for corn.

ARS Soil Scientist W. E. Larson recognizes two soil zones in cornfields. He says the soil immediately around the seed and seedling roots is the seedling-environment zone, and the soil between plant rows is the water-management zone.

Larson says the needs of the zones should be determined independently. Conditions for plant growth in the seedling-environment zone often are different from requirements for erosion control and moisture conservation in the water-management zone.

This approach to tillage of corn requires that researchers first determine optimum soil conditions in each zone. Then the scientists choose machines to create these conditions. Formerly, researchers selected the machines and then determined how their use affected plant growth and soil conditions.

Larson identified seven factors that can be manipulated to meet requirements of corn in specific soil and climate situations. In the seedling-environment zone, there are four factors to regulate for good seed germination and seedling growth:

Soil temperatures affect plant growth in the early part of the season. Corn growth accelerates as temperatures rise from 50° to 90° F.; it slows down as temperatures rise from 90° to 110° F. Below 50° and above 110° growth ceases.

Bulk density—the mass or weight of soil per unit of volume—helps determine the soil's ability to supply oxygen and water for plants. The less dense the soil, the greater the space between particles for air and water. Density also determines ease with which roots penetrate soil.

Looseness of soil sometimes controls transmission of water to plant roots. In loose but insufficiently pulverized soil, spaces between particles may be so large that water cannot move readily through the soil.

Size of seedling zone must be large enough for unrestricted growth of seedling roots.

In the water-management zone, Larson names three factors to manipulate for conservation of surface water or removal of it:

Surface detention refers to water storage on the soil surface during intense rains or irrigation. Surface detention is made possible by small soil-surface irregularities that temporarily hold water for later intake into the soil.

Soil porosity describes the degree to which the soil mass is permeated by pores or cavities. Amount of pore space determines soil's ability to store water in the tilled layer.

Surface structure maintenance refers to preservation of infiltration capacity of soil when raindrops strike it. Measures such as mulching and rough tillage restrict crusting and preserve infiltration capacity.

In cooperation with the Iowa Agriculture and Home Economics Experiment Station, Larson is developing guides for managing the seven factors in principal soils of the Western Corn Belt. Research is continuing on other factors that may affect tillage requirements of corn. ☆

A Growing Industry

MAKING FEATHER MEAL FOR FEED

■ Once a costly disposal problem for poultry plants, feathers are now the basis of a growing $12 million-a-year meal industry.

This new industry, which turns feathers into a high-protein, stable, friable meal useful in feeds, stems from studies begun 12 years ago by Western utilization division scientists in Albany, Calif. Further research by ARS and State agricultural experiment station scientists aided the development.

At present, feather meal is made chiefly from broiler feathers, but use of turkey feathers is increasing. Rendering plants process most of the feathers, as well as offal from poultry plants.

The annual broiler crop of about 5.5 billion pounds provides feathers for about 150,000 tons of meal. About 80 percent of the feathers—approximately 120,000 tons—is being processed into meal. Present market value of feather meal is $100 a ton.

This value is increasing, so feather disposal is no longer an expense to poultry plants. Some renderers pay up to one-tenth of the value of the meal for raw feathers.

Processing the meal is a low-cost operation for renderers. Their equipment consists chiefly of a steam pressure cooker and grinders, which they use in other rendering operations.

There may be a future for byproduct plants integrated into poultry processing plants. Estimates obtained by USDA's Agricultural Marketing Service indicate that byproduct plants would be economically successful if production totaled at least 25 tons of feather and offal meals a week.

Broiler feathers are in continuous supply. Therefore, renderers can operate with little variation in volume. But turkey processing is more seasonal. A byproduct plant that operates with a processing plant on a shared-labor basis might prove especially suitable for large turkey processors.

Feather meal supplies producers with a feed product that contains more protein per pound than any other available material. Thus in a poultry ration it leaves more room for high-energy ingredients. Feather meal cannot be used as the sole protein supplement, however, because it is slightly deficient in certain amino acids. Combined with other protein (for example, soybean oil meal) it performs satisfactorily in rations. ☆

Handling Fresh Florida Oranges in

PALLET BOXES

■ Pallet boxes can be used efficiently and profitably to move fresh Florida oranges from grove to packing line, USDA scientists discovered in preliminary research.

Use of pallet boxes reduces fruit damage and permits handling at lower cost than the smaller field boxes in general use. Pallet boxes are 9 to 12 times larger than the field boxes, which hold about 2¼ bushels.

Pallet boxes can be used to reduce costs of large or many small operators. For example, an operator who uses 500,000 field boxes a year can shift to pallet boxes and save about $23,400. If the annual volume is 200,000 field boxes, the saving is about $9,600. In Florida, 50 to 75 million boxes of fresh citrus fruit are harvested and marketed annually.

USDA cooperated with the Florida Agricultural Experiment Station and the Brooksville Citrus Growers Association in this research.

Equipment for handling pallet boxes can be operated effectively in Florida citrus groves that have the proper tree spacing and soil conditions. Tractor forklifts used for handling the pallet boxes can be used for other purposes in the grove, if parts of the lift equipment are detached temporarily.

Flatbed trucks and semitrailers now used to transport field boxes need not be modified to haul pallet boxes. But bases of the pallet boxes should be somewhat less than 4 feet square, because two boxes fill the 8 feet allowed as maximum width for trucks. Even so, care must be used to place these boxes on the trucks so that the maximum legal width for highway equipment will not be exceeded. Pallet boxes should not be more than 30 inches high. Pickers have difficulty emptying heavy picking bags into boxes with higher sides.

Citrus fruit must be degreened with ethylene gas before being packed. In the study, quality of fruit degreened in pallet boxes was equal to or better than fruit in field boxes. Where changes are needed to adapt existing degreening rooms for use

Quality of oranges degreened (by ethylene gas after curtain was lowered) in pallet boxes was as good as or better than that of fruit degreened in field boxes.

Pickers empty oranges into pallet boxes in grove. Boxes are moved by forklift truck and loaded onto semitrailer for transportation.

with pallet boxes, costs will normally be less than for construction of bulk degreening bins of equal capacity.

- Researchers comparing changes needed for a shift from field boxes to pallet boxes or bulk handling say pallet boxes offer these advantages:

A smaller investment is required in the packinghouse, because present degreening rooms can be readily adapted for using pallet boxes.

One system can be used for large and small groves, long and short hauls. and in mixed plantings.

Fruit can be kept separated according to variety, grove, or grower.

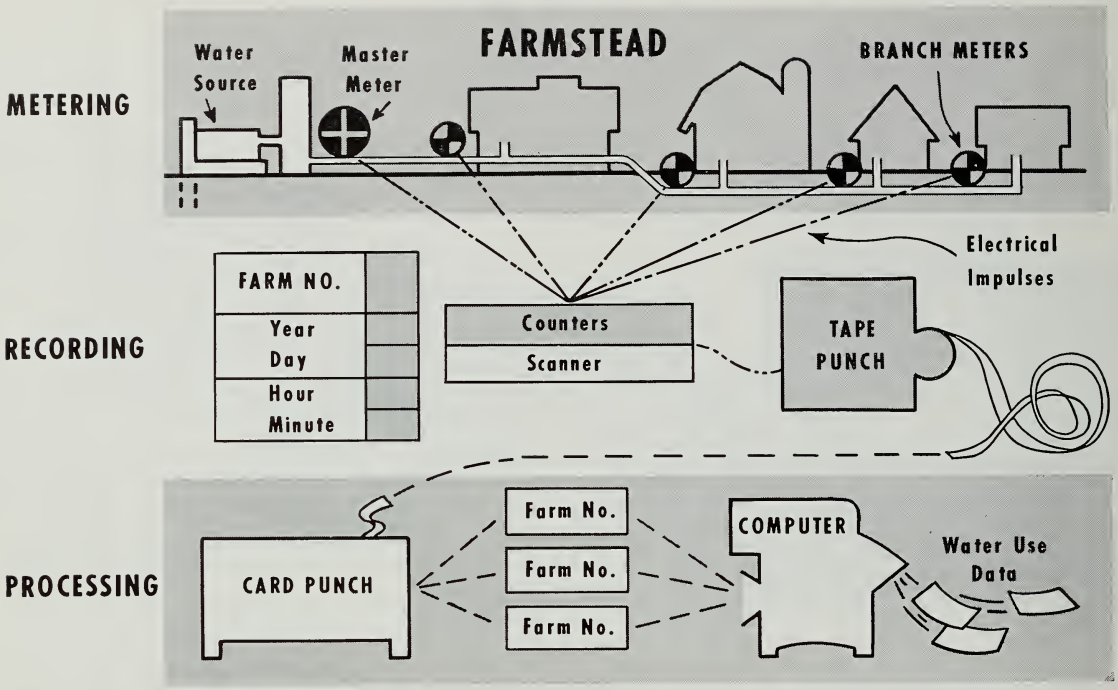
And tractors equipped with forks during harvesting can be used without forks during nonharvest periods.

- The scientists also found some disadvantages:

Fruit cannot be pregraded and presized before degreening—unless there is additional handling.

Forklift trucks and drivers are necessary for intrahouse transportation. However, movement of pallet boxes by floor-chain conveyors may become possible.

Depreciation of pallet boxes may be much more rapid than of equivalent bulk-handling equipment. Of course, depreciation of carts, small bulk trucks, and special truck loaders needed for bulk handling must also be considered. This equipment cannot be used during nonharvest periods.☆



DETERMINING FARM WATER NEEDS

How much water does it take to maintain a dairy herd? How much water is used in the farm home?

These are some of the questions USDA agricultural engineers and home economists hope to be able to answer after a water-use study on several Maryland dairy farms.

An elaborate electronic system for automatically measuring and recording the amount of water used on the farms has been developed by ARS agricultural engineers E. E. Jones, Jr., and W. A. Bailey. They are cooperating with the University of Maryland, College Park.

Data from the study will be used in making recommendations for more efficient use of water on the farm and in the farm home. For example: if a farmer decides to establish a dairy farm—or if a dairy farmer wants to increase the size of his herd—information from the study can be used to relate the amount of available water to needs.

Data will aid in appliance selection

Home economist Joan C. Courtless is studying use of water in the kitchen, bath, and laundry. The data she collects will be helpful to farm women in knowing what size water heater to select. It will also help them know if the water system is adequate for additional water-consuming equipment (washing machine, dish washer, garbage disposal).

Jones says farmers need up-to-date information on the water requirements for doing various farm and home tasks so they can plan adequate water systems. Extension workers will use this information in guiding farmers in such planning.

Pump manufacturers will find the data useful in developing more efficient pumps and water systems, and health and sanitary officials can use the data in considering water codes and ordinances.

Only dairy farms are being studied initially, because water use and standards are higher than on most other types of farms. The project will eventually include other types of farms in several States.☆

GOOD EATING QUALITY IN LEAN PORK ROASTS

■ A lean pork roast can be as juicy and tender as one with generous marbling and thick fat covering.

This and several other findings of USDA researchers should be helpful to homemakers in selecting fresh pork roasts in the market. The conclusions are based on a study of the eating quality of fresh pork roasts of varying fat content. The study included the seven most popular retail cuts of fresh pork: Picnic shoulder, shoulder butt, ham—shank and butt, and loin—rib, center, and end.

ARS food scientists Olive M. Batcher, Elsie H. Dawson, and Gladys L. Gilpin, and statistician J. N. Eisen studied 283 fresh pork roasts from 32 animals. The animals were of the same weight and age group but varied from very fat to very lean.

Both raw and cooked cuts were analyzed for proportions of fat, lean, and bone. Cooking was done in an open pan in an oven at 325° F., a recommended household method. The meat was cooked to an internal temperature of 185° F. (well done). Juiciness and flavor were rated by taste panel. Tenderness was rated by shear test and by taste panel.

Though some earlier studies indicated a direct relation between fat content and eating quality, this more extensive research led to new conclusions.

Tenderness and juiciness of most of these roasts were not related to the amount of fat they contained. Neither amount of fat around the lean nor amount of marbling in the lean showed any relation to eating quality in most cuts. All cuts except the picnic shoulder were as tender with very little marbling as with generous marbling. All cuts except the ham shank were equally juicy, whether the lean had a low or high fat content. Flavor differences were slight; most cuts had the full roast pork flavor.

When buying a pork roast, most consumers want to know which cuts have the most lean. Analyses showed that the butt end of fresh ham has a higher proportion of lean than the shank, and that in loin cuts the loin end has more lean than the rib end.

Consumers also want to know how much will be lean after cooking. Cooked lean will average about 40 percent by weight of the raw trimmed cut.

Another consideration is cooking time. The thinner the fat covering, the shorter the cooking time.☆

OAT FROM IRRADIATED SEED

■ Irradiation has been used successfully for the second time in developing an oat strain with improved resistance to disease.

The strain, Alamo-X, originated from seed irradiated with X-rays at the Brookhaven National Laboratory of the Atomic Energy Commission, Upton, N.Y. ARS scientists, in cooperation with the Texas Agricultural Experiment Station, selected Alamo-X from the fifth-generation progeny.

Florad, the first oat strain resulting from the use of irradiation, was developed in 1959 by ARS and the Florida Agricultural Experiment Station. This oat is now produced in Florida.

Alamo, the parent variety of Alamo-X, has declined in popularity because of damage by Victoria blight and races 216 and 290 of crown rust. Alamo-X resists these diseases. However, it is susceptible to race 294 that appeared in Texas last year.

Alamo-X is more cold hardy than Alamo and has shown good forage characteristics in tests. Thus, it is adapted in northern Texas where oats are grown primarily for grain and in the southern part of the State where they are grown chiefly for forage.

Regional tests to determine the strain's adaptability in other southern States are in progress.

Irradiation causes a wide variety of genetic and cytological changes in plants. Favorable changes are produced only rarely. When they do occur, they usually are accompanied by undesirable ones that must be bred out of a strain.

One common effect of irradiation is male sterility in the progeny. Male sterility, in turn, increases hybridization because pollen from other strains growing in a nursery fertilizes the male-sterile plants. Many improvements found following irradiation probably are the result of hybridization, rather than genetic changes induced directly by irradiation, scientists say. The genetic makeup of Alamo-X may be the result of such hybridization.

Irradiation has been used by ARS and State plant breeders to develop new strains of peanuts, bush beans, and turf grasses.

Seed of Alamo-X is commercially available. Foundation seed was released to certified seed growers in central Texas for increase in 1961.☆

SPEEDING TOBACCO SEEDLING GROWTH

Average: 30 plants per square yard. Ammonium sulfate applied.

Average: 189 plants per square yard. Ammonium sulfate applied.

■ Ten days can mean a lot to a tobacco grower waiting for seedlings to get big enough for transplanting.

That's about how much time he's likely to gain if he fumigates his seedling beds with methyl bromide gas in the fall instead of in spring. This was shown in research by scientists of USDA and the Tennessee Agricultural Experiment Station.

Methyl bromide gas applied in the spring can interfere with the availability of nitrogen to plants.

Plant production proved generally more satisfactory when the gas was applied in the fall during a series of test comparisons made in east Tennessee soils from 1958 to 1961.

Averages of results in all beds show that seedlings reached transplant size about 10 days earlier in fall-fumigated beds than in spring-fumigated beds. In addition, most fall-fumigated beds yielded more plants at the first pulling.

Use of methyl bromide to kill weeds and disease organisms has become widespread, because it is economical and effective. But the gas also inhibits development of soil bacteria. Among organisms inhibited are those that convert nitrogen into nitrates, the form in which this nutrient is absorbed by plants. Much of the nitrogen supplied in fertilizer must be converted into nitrates before plants make use of it.

In spring-fumigated beds, nitrifying bacteria may not recover from methyl bromide treatment in time to benefit the tobacco seedlings.

Previous to this research, no exact knowledge was available about the difference between applying the fumigant in the fall or in the spring just prior to fertilization and seeding. Nor was it known if it was more advantageous to use any particular nitrogen fertilizer in conjunction with methyl bromide treatment.

Nitrogen sources vary in effectiveness

Some fertilizers are more effective than others as sources of nitrogen for tobacco seedlings, the scientists found. Results indicated that ammonium sulfate, urea, and a mixture (one-third each of ammonium sulfate, urea, and nitrate of soda) were equally satisfactory as sources of nitrogen in fall-fumigated beds.

Here is the average number of plants obtained per square yard at the first pulling in fall-fumigated beds fertilized with a different source of nitrogen: 195, urea; 189, ammonium sulfate; 183, the mixture; and 136, nitrate of soda.

The average number of plants per square yard at first pulling in spring-fumigated beds was: 30, ammonium sulfate; 73, urea; 143, the mixture; and 140, nitrate of soda.

Average numbers of plants obtained at first pulling from spring-fumigated beds fertilized with nitrate of soda or the mixture containing it were higher than from beds receiving the other fertilizers. But these averages were not as high as averages of plants in fall-fumigated beds fertilized with ammonium sulfate, urea, or the mixture.

These differences are explained by leaching variability among the fertilizers and the form of nitrogen required by tobacco plants, the scientists say. Nitrogen in nitrate of soda is readily available to plants. However, the nitrate ion is easily leached downward in soil beyond the reach of shallow-rooted tobacco plants. For this reason, nitrate of soda is unreliable as a single source of nitrogen applied at seeding.

Nitrogen in ammonium sulfate and urea doesn't leach readily but must be acted upon by nitrifying bacteria before it is available to plants.☆

For California Growers

RICE THAT SURVIVES IN COLD WATER

■ Rice tolerant to cold irrigation water is needed by California growers and may be on the way. Cold water delays emergence and reduces stands, tillering, and yields.

So far, researchers have evaluated more than 50 leading U.S. and foreign varieties for cold water tolerance and developed advanced techniques for making these tests. This work is being done by USDA and California Agricultural Experiment Station scientists who are cooperating in a rice-improvement program.

Plans call for breeding new varieties with increased tolerance to cold water, study of the mode of inheritance of tolerance, and more detailed research than any yet attempted on how cold water affects the growth of rice plants.

The most recent accomplishment is development, at the Agricultural Research Center, Beltsville, Md., of a relatively quick and simple laboratory method for evaluating tolerance. It consists, first, of sowing seed in jars of water held at the desired low temperature. Later, the length of the longest leaf on each varietal sample and the percent of seedlings surviving 30 days after sowing are calculated as measures of tolerance to cold water.

Old and new test methods were compared

Results agreed substantially with those obtained by using the conventional method of sowing rice in pots and then submerging the pots in cold water. Seedling length and survival were comparable in these tests and in field studies.

Thus far, no variety has been found to have more cold water tolerance than U.S. Caloro, although six U.S. varieties equaled Caloro in the test of leaf length. Many equaled Caloro in seedling survival. Several varieties from Japan, China, Taiwan, Korea, and Portugal also show promise of being equal to Caloro.

California growers are plagued by cold water damage to rice because of the generally low temperature of irrigation water. California produces about 20 percent of the rice grown in the United States.

The major California producing area is the Sacramento River valley. Many growers there use water from the Sacramento River, the headwaters of which are impounded in the Shasta Reservoir. The temperature of this water averages about 60° F. Rice yields have been reduced by 5 percent in some seasons, and losses have been larger in certain localities.

Cold water could cause greater losses in the future, especially when water is available from the Feather River following construction of the proposed Oroville Dam. Temperatures of Feather River water are expected to range from 50° to 55° F.☆

New facts about reproduction of a forage grass provide basis for

IMPROVING CROPS

■ Revolutionary changes in ways of breeding improvements into many forage grasses and other crops could result from findings of ARS geneticist E. C. Bashaw.

He thinks such improvements are possible—after learning new facts about reproduction of buffelgrass, a forage species.

- Buffelgrass, formerly assumed to reproduce only by asexual seed, reproduces sexually in some instances.
- Bashaw has shown that sexuality and asexuality in buffelgrass are inherited characteristics—and that individual plants are apparently completely sexual or asexual. This is different than in some species, like Kentucky bluegrass, where a single plant may produce sexual and asexual seed.
- Bashaw also says that asexuality is recessive (subordinate) to sexuality in the species.

(In sexual plant reproduction, the egg cell is fertilized by pollen and offspring are of either sex. In asexual reproduction, seed development occurs without normal fertilization, and all the offspring are the same as the mother plant.)

Bashaw's discoveries provide plant geneticists with important advances in understanding the mechanism of asexuality. Asexuality of seed plants is just beginning to be understood. It occurs in many plant types, including other grass species grown for forage and turf. Ordinarily, vigorous asexual plants have the ability to colonize large areas that have uniform growing conditions.

But asexuality usually precludes varietal improvement by eliminating the possibility of introducing new genetic material through crosses. If breeders fully understood the mechanism of asexuality, they would be able to manipulate it.

Desired qualities could be introduced by way of the sexual form of a plant to the asexual form. Fixed in the sexual form, these characteristics would be inherited by progeny and could be incorporated into true-breeding hybrids. This would allow doing away with many generations of reselection from crosses, a costly and time-consuming job.

The immediate importance of Bashaw's work is that it provides a chance to improve buffelgrass by sexual breeding. Forage and seed yields can be increased, and the species can be made more cold hardy.

Plant material used in Bashaw's research was found by chance in a field of asexual blue buffelgrass near Southerland Springs, Tex. The plant was noticed because of its highly variable progeny: some were sexual and others asexual.

Bashaw found that the progeny reproduced at a ratio of 47 sexual plants to 3 asexual plants. Careful examination of developing plant structures indicated that each plant was completely sexual or asexual. He also noted that reproduction in the asexual seed was accompanied by enlargement of several cells in the nucellus, the outer tissue enclosing the seed.

Buffelgrass is a perennial, warm-season bunchgrass that was introduced successfully in parts of the South and Southwest. Native to India and Africa, it is well adapted to warm arid and semiarid conditions.☆

Outstanding results in silage test

Excellent low-moisture alfalfa silage has been made in conventional upright silos by ARS scientists. Low-moisture silage (from field-wilted and chopped alfalfa) is usually made in glass-lined, gastight silos.

Two tile silos, typical of most conventional ones on farms, were used at USDA's Agricultural Research Center, Beltsville, Md. The silage was comparable in feeding value to the alfalfa baled as hay. Milk cows, heifers, and sheep fed the silage did as well or better than those fed the hay. Comparisons were made of milk yields, weight gains, dry matter intake, and digestibility.

Very good silage preservation occurred in both silos. Only 1.3 percent spoilage occurred in one filled and sealed as carefully as possible;

more than 91 percent of the alfalfa that went into it was fed.

In the other silo, spoilage was only 3 percent, and 95 percent of the silage was fed. Low-moisture alfalfa was put in and tramped down. Doors were closed without special sealing. When the silo was full, a plastic cover was placed on the silage and weighted with nonwilted alfalfa.

Doors of the carefully prepared silo were sealed with rubber gaskets. After silage was added and tramped down each day, damp nonwilted alfalfa was put on top to keep air from the silage. After this silo was filled, the silage was covered with the plastic and nonwilted alfalfa.

The study was done by ARS dairy husbandman J. C. Derbyshire and associates and agricultural engineer J. R. McCalmont. They mowed, crushed, and windrowed the alfalfa. Then it was chopped and ensiled (at 55 percent average moisture content) a day or two before alfalfa mowed at the same time was ready to bale.

Hornworm trapping test is underway

The first large-scale test of blacklight traps to capture tobacco hornworm moths is being made by scientists of USDA and the North Carolina Agricultural Experiment Station.

Previous experience has shown that such traps attract hornworm moths, but this test is the first involving a concentration of traps in what scientists call a "countywide" area. The test area covers about 113 square miles and contains 370 traps.

The experiment was made possible through the cooperation of 370 tobacco growers, who agreed to installation and maintenance of the traps by ARS scientists at Oxford, N.C.

Each trap consists of a fluorescent lamp that attracts the hornworm moths, and a device to trap them. The light emitted is frequently called blacklight, because the rays are in the near-ultraviolet range barely visible to humans.

The traps were put into use May 15, and the field phase of the experiment is to continue until October 15. Scientists are making periodic releases of marked moths and detailed studies of moth catches.

ARS entomologist F. R. Lawson, leader of tobacco insect investigations at Oxford, is directing the research. ARS agricultural engineer J. M. Stanley installed the traps and is in charge of their maintenance.

Oat for California resists rust

Sierra, a new rust-resistant oat for California, is the product of a cross between a wild oat and a genetically incomplete oat hybrid.

In developing the new variety, plant breeders used pollen from the wild oat *Avena fatua* to fertilize a monosome hybrid which has one less chromosome than normal oats. The hybrid parent was the product of a cross between Kanota, a widely grown red oat, and a gentically defective red oat (a nullisome) that has one pair of chromosomes missing.

By fertilizing the female parent with the wild oat, breeders replaced the missing chromosome. This was done by ARS agronomist C. A. Suneson and cooperators at the California Agricultural Experiment Station.

Sierra is the second oat produced by USDA from a parent deficient in chromosomes. Curt, a short-stemmed red oat developed by Suneson, was released in 1960 (AGR. RES., January 1960, p. 15). This was the first time a wild oat has been used in developing a commercial variety.

Breeders say the value of wild oats as breeding material is demonstrated

by the good qualities *Avena fatua* imparted to Sierra. Among these good qualities is resistance to crown and stem rusts, a trait that originated in the wild oat. Because this resistance differs genetically from resistance found in other cultivated varieties, it is considered to be valuable insurance in the event of a general rust epidemic that could affect all cultivated

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varieties in the U.S. at the same time.

Certified seed of Sierra is available to growers. A list of seed producers can be obtained from M. D. Miller, extension agronomist at the University of California, Davis. No seed is available from USDA.

ARS scientists win national award

H. A. Borthwick and S. B. Hendricks of ARS have been awarded the 1962 Hoblitzelle National Award in the Agricultural Sciences.

Consisting of $10,000, plus a gold medal and attesting certificate for each man, the award is granted biennially to a scientist or scientific team for the greatest contribution to American agriculture during the preceding 4 years. The award is conferred by the Hoblitzelle Foundation of Dallas, Tex.

Borthwick and Hendricks received the award for discovering how phytochrome, the light-sensitive plant pigment, controls plant development. They have already received USDA's Distinguished Service Award.

Their discovery gives plant breeders basic knowledge for learning how to control growth from seed germination through flowering and fruiting. Eventually, this knowledge should enable breeders to tailor plants to meet specific demands. Already developed are plants of special heights to increase harvesting efficiency, and plants that flower at convenient times.

Borthwick is chief plant physiologist of USDA's Pioneering Research Laboratory for Plant Physiology. Hendricks is chief scientist of the Pioneering Research Laboratory for Mineral Nutrition of Plants. Both laboratories are at Beltsville, Md.

S. B. Hendricks

H. A. Borthwick

Greater use of nonfat milk solids

If more women had streamlined figures in 1960 than in 1950 there's a reason. Between 1950 and 1960, use of nonfat milk solids in fluid milk and dairy products climbed steadily upward, and use of milk fat went down.

Figures published by USDA's Economic Research Service show that the total nonfat milk solids used in fluid milk and dairy products increased 26 percent during the 10-year period. During the same period, milk production increased only 5 percent, and the use of milk fat in foods increased less than 1 percent.

A change in the way farmers market milk is the primary reason for the increased use of nonfat solids from milk. In 1950, farmers sold about 20 percent of all milk as separated cream. Skim milk was usually fed to animals on the farm. In 1960, farmers sold only 6 percent of all milk as separated cream.

A large part of the increasing supply of nonfat milk solids has been used in producing nonfat dry milk. Commercial sales of nonfat dry milk increased greatly during the 10-year period. And USDA distributed large amounts in this country through the National School Lunch Program and various welfare agencies.

USDA also shipped large amounts of nonfat dry milk to countries in the Food-for-Peace Program.

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